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STARTERKIT

SK-S12(X) Series
ZK-S12(X) Series

Starter Kits for Freescale HCS12(X) Family

User's Manual

SofTec® MICROSYSTEMS

Development Tools for the Embedded World

SK-S12(X) Series
ZK-S12(X) Series

Starter Kits for
Freescale HCS12(X) Family

User's Manual

Revision 1.0

SofTec MICROSYSTEMS

Development Tools for the Embedded World

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DC00891

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0 Before Starting

0.1 Important Notice to Users

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0.2 Required Skills

In order to beneficially use the Starter Kit, you should be acquainted with certain skills, ranging from hardware to software design. In particular, you should possess knowledge of the following:

- Microcontroller systems;
- HCS12(X) architecture knowledge;
- Programming knowledge (Assembly and C).

1 Overview

1.1 Main Features

The SK-S12(X) and ZK-S12(X) Series Starter Kits are full-featured, ready-to-use evaluation boards for the Freescale HCS12(X) family. The Starter Kits have been designed for the evaluation and the debugging of user applications.

The Starter Kits take advantage of CodeWarrior Development Studio (which groups an Editor, Assembler, C Compiler and Debugger) and the Freescale BDM interface, which allows the download and debug of the user application into the microcontroller's FLASH memory.

Together with CodeWarrior, the Starter Kits provide you with everything you need to write, compile, download, in-circuit emulate and debug user code. Full-speed program execution allows you to perform hardware and software testing in real time. The Starter Kits are connected to the host PC through a USB interface. A prototyping area allows you to wire your own small application.

Note: *on ZK Series, a ZIF (Zero Insertion Force) socket is provided which allows easy microcontroller insertion/extraction.*

The Starter Kits offer you the following benefits:

- Real-time code execution;
- In-circuit debugging;
- In-system programming and debugging through a BDM-compatible interface;
- Demo area with push-buttons, potentiometer, DIP-switches and user LEDs;
- Where available: RS-232 ports, CAN transceivers, LIN transceivers and other target-specific peripherals;

- Prototyping area;
- CodeWarrior for HC(S)12 Development Studio, Special Edition, with editor, assembler, C compiler and debugger.

Note: *this user's manual explains methods and procedures common to all of the SK-S12(X) and ZK-S12(X) Series Starter Kits. For a detailed list of the hardware features of your specific Starter Kit, please refer to the Starter Kit's specific user's manual, available in PDF format on the SofTec Microsystems'* ***"System Software"*** *CD-ROM.*

1.2 Background Debug Module (BDM)

All MCUs in the HCS12(X) family contain a single-wire background debug interface which supports in-circuit programming of on-chip non-volatile memory and sophisticated non-intrusive debug capabilities. This system does not interfere with normal application resources. It does not use any user memory or locations in the memory map and does not share any on-chip peripherals. The background debug module (BDM) uses a single-wire communication interface to allow non-intrusive access to target system memory and registers.

The Starter Kits feature a USB to BDM interface which allows the host PC to communicate with the microcontroller through a standard USB cable.

Contrariwise to traditional in-circuit emulation (where the target application is executed and emulated inside the emulator), the Starter Kits use the very same target microcontroller to carry on in-circuit execution. This means that all microcontroller's peripherals (timers, A/D converters, I/O pins, etc.) are not reconstructed or simulated by an external device, but are the very same target microcontroller's peripherals. Moreover, the Starter Kits' debugging approach ensures that the target microcontroller's electrical characteristics (pull-ups, low-voltage operations, I/O thresholds, etc.) are 100% guaranteed.

1.3 CodeWarrior Development Studio Special Edition

The Starter Kits come with CodeWarrior Development Studio, Special Edition.

CodeWarrior Development Studio is a powerful and easy-to-use tool suite designed to increase your software development productivity. It provides unrivalled features such as Processor Expert application design tool, full chip simulation, data visualization and project manager with templates to help you concentrate on the added value of your application.

The comprehensive, highly visual CodeWarrior Development Studio enables you to build and deploy HCS12(X) systems quickly and easily. This tool suite provides the capabilities required by every engineer in the development cycle, from board bring-up to firmware development to final application development.

Without a license key, the product will run in a 1 KB code-size limited demonstration mode.

To break the 1 KB limit, you have two options:

1. Contact Metrowerks to request an unlimited period, free license key to increase the code size limit to 32 KB;
2. Contact Metrowerks to request a 30-day limited, free license key to run the compiler without limitations.

This documentation covers the basic setup and operation of CodeWarrior Development Studio, but does not cover all of its functions. For further information, please refer to the CodeWarrior online help and online documentation provided.

1.4 Recommended Reading

This documentation describes how to use the Starter Kits and how to set up basic debugging sessions with CodeWarrior. Additional information can be found in the following documents:

- **Microcontroller Datasheets;**

- **Starter Kit's Specific User's Manual;**
- **Starter Kit's Specific Schematic.**

Additionally, we suggest to read Freescale Application Notes and Engineering Bulletins available on the Freescale website (*www.freescale.com)* for updated documentation about the microcontroller that you are using.

1.5 Software Upgrades

The latest version of the Starter Kits' system software is always available free of charge from our website: *http://www.softecmicro.com.*

When installing the Starter Kits' system software you have the option to electronically register the product. If you register the product, you will be automatically notified by e-mail every time a new version of the system software is available.

1.6 Getting Technical Support

Technical assistance is provided to all customers. For technical assistance, documentation and information about products and services, please refer to your local SofTec Microsystems partner.

SofTec Microsystems offers its customers a technical support service at *support@softecmicro.com*. Before getting in contact with us, we advise you to check that you are working with the latest version of the Starter Kits' system software (upgrades are available free of charge at *http://www.softecmicro.com*).

2 Hardware Features

2.1 Standard Features

Every SK-S12(X) and ZK-S12(X) Series Starter Kit features a common set of functions, listed below.

- MCU section
- Power supply section
- USB to BDM interface
- BDM connector
- Reset section
- Inputs section
- Outputs section
- RS-232 section
- Prototype area

Additionally, each Starter Kit may feature special additional functions.

Note: *for a detailed list of the hardware features of your specific Starter Kit, please refer to the Starter Kit's specific user's manual, available in PDF format in the SofTec Microsystems'* ***"System Software"*** *CD-ROM.*

The standard functions are explained in the following sections.

2.1.1 MCU Section

This section contains the following components:

- The microcontroller (installed on a ZIF socket on ZK-S12(X) series);
- Header connectors to access the I/O pins of the microcontroller;
- An oscillator area to configure the clock source of the microcontroller;
- MCU jumpers for setting the microcontroller's operating mode, the microcontroller's internal voltage regulator and the microcontroller's internal A/D converter voltage reference.

2.1.2 Power Supply Section

The Power Supply section takes a 12 V DC voltage and, thanks to the built-in power supply, provides a regulated voltage for the rest of the board.

2.1.3 USB to BDM Interface

The USB to BDM interface is a circuitry that electrically and logically translates BDM-like commands sent by the host PC through the USB cable to the BDM interface of the microcontroller.

Note: *to bypass the built-in USB to BDM interface when using an external in-circuit debugger (via the BDM connector), please remove the* ***"RESET ENA"*** *and* ***"BKGD ENA"*** *jumpers.*

2.1.4 BDM Connector

Even though the SK-S12(X) and ZK-S12(X) Series Starter Kits feature a built-in USB to BDM interface, a separate, standard BDM connector is present which allows an external in-circuit debugger to be used.

2.1.5 Reset Section

This section groups a reset push-button and a reset circuitry to generate a suitable reset signal for the microcontroller and for the peripherals connected to it.

2.1.6 Inputs Section

All of the SK-S12(X) and ZK-S12(X) Series Starter Kits feature an input area with various input controls like a potentiometer, DIP-switches and push-buttons. Some Starter Kits may feature additional functions.

2.1.7 Outputs Section

This section features high-efficiency (low-current) LEDs, connected to the microcontroller through jumpers. Some Starter Kits may feature additional functions.

2.1.8 RS-232 Section

Depending on the specific Starter Kit, one or more RS-232 channels are available. Each RS-232 channel is TIA/EIA-232-F compliant (up to 250 Kbit/s) and can be configured as DTE (Data Transmission Equipment) or DCE (Data Communication Equipment) via the relative jumper.

2.1.9 Prototype Area

The prototype section features both a standard, thru-hole area (for mounting traditional components) and a SMD area (for soldering SMD components).

3 Getting Started

3.1 Package Contents

The Starter Kit includes the following items:

- A full-featured evaluation board;
- An AC adapter;
- A USB cable;
- The SofTec Microsystems **"System Software"** CD-ROM;
- The CodeWarrior Development Studio Special Edition CD-ROM;
- A QuickStart Tutorial poster;
- A registration card;
- This user's manual.

3.2 Operating Mode

The Starter Kit can work in two ways: Standalone mode and Host mode.

3.2.1 Standalone Mode

In Standalone mode, no PC connection is required. The microcontroller is factory programmed with a sample application which reads the potentiometer value and displays the results on the output area.

To work in standalone mode, the **"BKGD ENA"** and **"RESET ENA"** jumpers in **"USB TO BDM INTERFACE"** section must be removed and you must verify that no BDM-based in-circuit debugger/programmer is connected to the BDM connector.

To run the built-in example:

1. Verify that all jumpers are in their default position. See the *"Summary of Jumper and Connector Settings"* chapter on the Starter Kit's specific user's manual.
2. Power up the Starter Kit. The power connector accepts a 12 V DC wall plug-in power supply with a 2.1 mm pin and sleeve plug with positive in the center and sleeve as ground. The green **"POWER"** LED on the board should turn on.
3. By rotating the potentiometer, you affect the results of the A/D conversion, and the value of each conversion is displayed on the **"OUTPUTS"** section.

3.2.2 Host Mode

In Host mode the program execution is controlled by the host PC. You can use the PC to debug the application by, for example, executing the program step by step and watching how the microcontroller registers vary, using CodeWarrior Development Studio provided.

In Host mode the Starter Kit can be controlled via the built-in USB to BDM interface or in conjunction with a BDM-based emulator/programmer.

Note: *to bypass the built-in USB to BDM interface when using an external in-circuit debugger (via the BDM connector), please remove the **"RESET ENA"** and **"BKGD ENA"** jumpers.*

When debugging the microcontroller (either using an external in-circuit debugger via the BDM connector or using the built-in USB connector), you must remove the **"MODA=1"** and **"MODB=1"** jumpers.

This manual explains how to debug the application using the built-in USB to BDM interface. Please refer to your development tool's user's manual if you need to control the Starter Kit via the BDM connector.

3.3 Host System Requirements

The Starter Kit is controlled by CodeWarrior Development Studio. The following hardware and software are required to run the CodeWarrior user interface together with the Starter Kit:

1. A 200 MHz (or higher) PC compatible system running Windows 98, Windows 2000 or Windows XP;
2. 128 MB of available system RAM plus 500 MB of available hard disk space;
3. A USB port;
4. CD-ROM drive for installation.

3.4 Installing the Software

Note: *before connecting the Starter Kit to the PC, it is recommended that you install all of the required software first (see below), so that the appropriate USB driver will be automatically found by Windows when you connect the Starter Kit.*

The Starter Kit requires that both CodeWarrior Development Studio Special Edition and SofTec Microsystems Additional Components be installed in the host PC.

Note: *CodeWarrior Development Studio for HC(S)12 must be installed first.*

3.4.1 Installing CodeWarrior Development Studio

To install the CodeWarrior Development Studio Special Edition, insert the CodeWarrior CD-ROM into your computer's CD-ROM drive. A startup window will automatically appear. Follow the on-screen instructions.

3.4.2 Installing SofTec Microsystems Additional Components

The SofTec Microsystems Additional Components install all of the other required components to your hard drive. These components include:

- The Starter Kit's USB driver;
- The software plug-in for CodeWarrior;
- DataBlaze programming utility;
- Examples;
- Starter Kit's specific user's manual;
- Starter Kit's specific schematic;
- Additional documentation.

To install the SofTec Microsystems Additional Components, insert the SofTec Microsystems **"System Software"** CD-ROM into your computer's CD-ROM drive. A startup window will automatically appear. Choose **"Install Instrument Software"** from the main menu. A list of available software will appear. Click on the **"Additional Components"** option. Follow the on-screen instructions.

Note: *to install the Additional Components on Windows 2000 or Windows XP, you must log in as Administrator.*

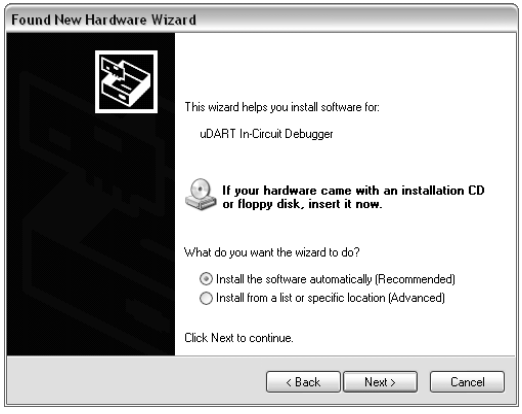
3.5 Installing the Hardware

The Starter Kit is connected through a USB port to a host PC. Connection steps are listed below in the recommended flow order:

1. Install all the required system software as described in the previous section.
2. Power up the Starter Kit. The power connector accepts a 12 V DC, wall plug-in power supply with a 2.1 mm pin and sleeve plug with positive in the center and sleeve as ground. The green **"POWER"** LED on the board should turn on.
3. Insert one end of the USB cable into a free USB port on the host PC.
4. Insert the other end of the USB cable into the USB connector on the Starter Kit board.
5. The first time the Starter Kit is connected to the PC, Windows recognizes the instrument and starts the **"Found New Hardware Wizard"** procedure, asking you to specify the driver to use for the instrument. On Windows XP (SP2) the following dialog box will appear, asking you to search for a suitable driver on the web.

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

   Select the **"No, not this time"** option and click the **"Next >"** button.
6. The following dialog box will appear.


Found New Hardware Wizard
This wizard helps you install software for:
uDART In-Circuit Debugger
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

Click the **"Next >"** button.

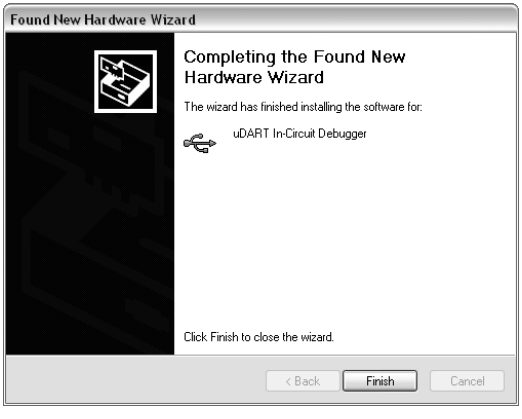
7. Depending on your Windows settings, the following warning may appear.

Hardware Installation
The software you are installing for this hardware:
uDART In-Circuit Debugger
has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation

Note: *this warning is related to the fact that the USB driver used by the Starter Kit is not digitally signed by Microsoft, and Windows considers it to be potentially malfunctioning or dangerous for the system. However, you can safely ignore the warning, since every kind of compatibility/security test has been carried out by SofTec Microsystems.*

Click the **"Continue Anyway"** button.

8. Windows will install the driver files to your system. At the end of the installation, the following dialog box will appear.



Click the **"Finish"** button to exit from the **"Found New Hardware Wizard"** procedure.

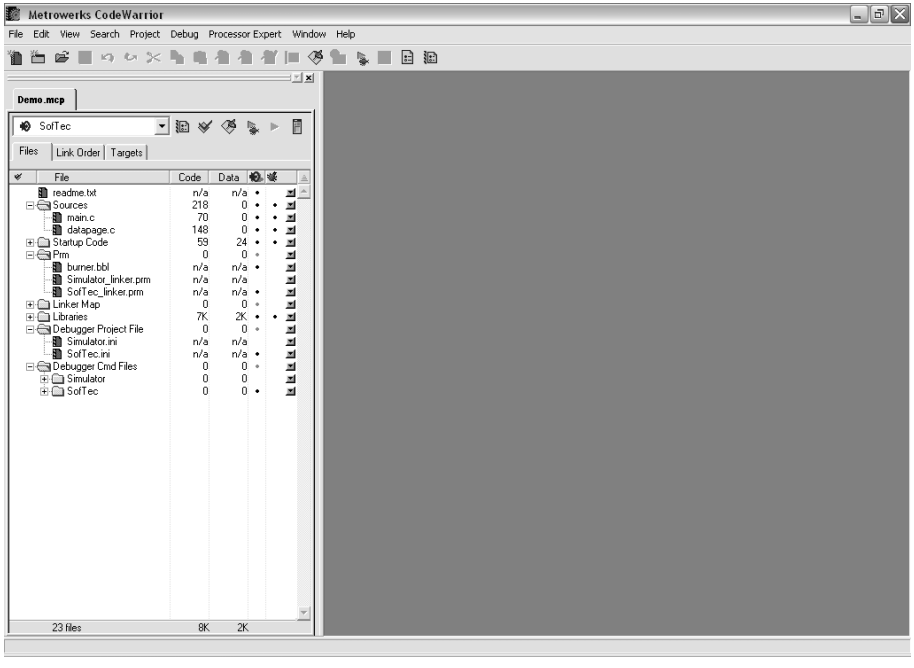
9. The Starter Kit's USB driver is now installed on your system.

3.6 Application Tutorial

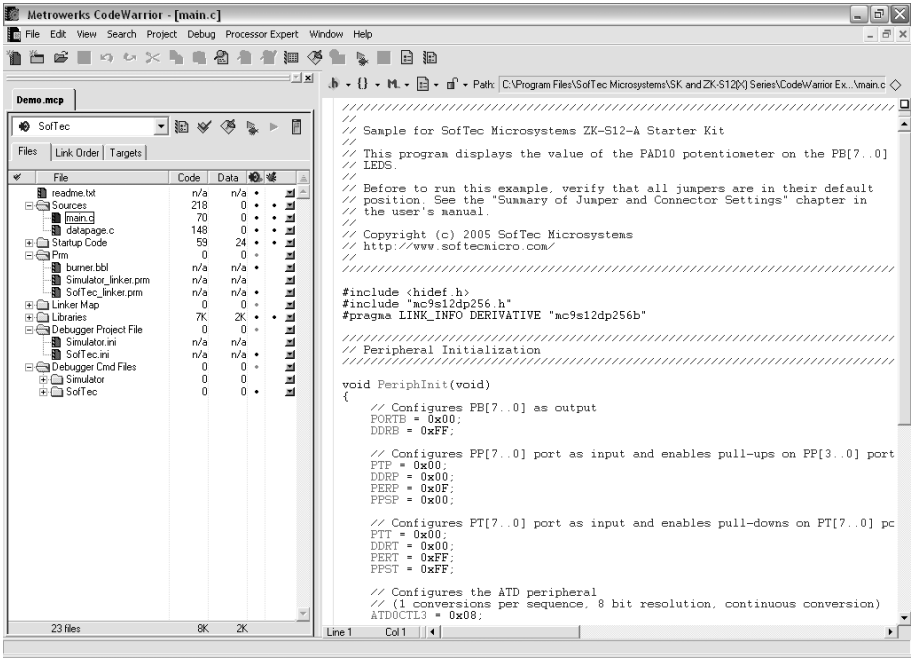
This section will provide a step-by-step guide on how to launch your project and get started with the CodeWarrior user interface.

1. Ensure that the Starter Kit is connected to the PC (via the USB cable) and that the board is powered.
2. Make sure that all of the Starter Kit's jumpers are set to their factory position (see the *"Summary of Jumper and Connector Settings"* section in the Starter Kit's specific manual).
3. Start CodeWarrior Development Studio by selecting **"Start > Programs > SofTec Microsystems > SK and ZK-S12(X) Series > CodeWarrior Development Studio"**. CodeWarrior Development Studio will open.

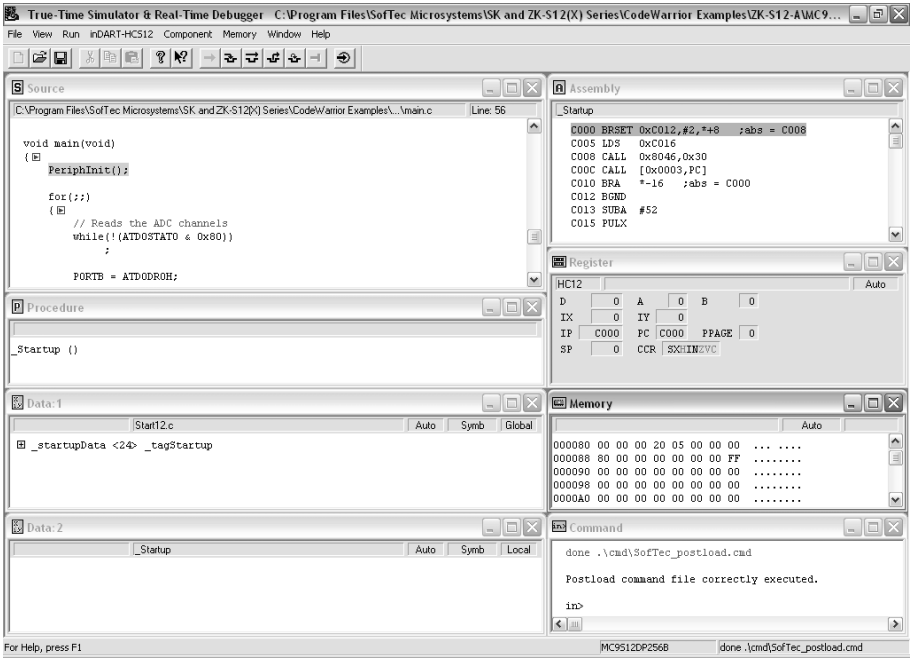
4. From the main menu, choose **"File > Open"**. Select the **"Demo.mcp"** workspace file that is located under the **"\Program Files\SofTec Microsystems\SK and ZK-S12(X) Series\CodeWarrior Examples *[Your Starter Kit Code]**[Your Target Microcontroller]*\Demo"** directory. Click **"Open"**. The following window will appear.



5. The C code of this example is contained in the **"main.c"** file. Double click on it to open it. The following window will appear.


Metrowerks CodeWarrior - [main.c]
File Edit View Search Project Debug Processor Expert Window Help
Demo.mcp
SofTec
Files Link Order Targets
File Code Data
readme.txt n/a n/a
Sources 218 0
main.c 70 0
datapage.c 148 0
Startup Code 59 24
Prm 0 0
burner.bbl n/a n/a
Simulator_linker.prm n/a n/a
SofTec_linker.prm n/a n/a
Linker Map 0 0
Libraries 7K 2K
Debugger Project File 0 0
Simulator.ini n/a n/a
SofTec.ini n/a n/a
Debugger Cmd Files 0 0
Simulator 0 0
SofTec 0 0
23 files 8K 2K
Path: C:\Program Files\SofTec Microsystems\SK and ZK-S12(X) Series\CodeWarrior Ex...\main.c
// Sample for SofTec Microsystems ZK-S12-A Starter Kit
// This program displays the value of the PAD10 potentiometer on the PB[7..0]
// LEDS.
// Before to run this example, verify that all jumpers are in their default
// position. See the "Summary of Jumper and Connector Settings" chapter in
// the user's manual.
// Copyright (c) 2005 SofTec Microsystems
// http://www.softecmicro.com/
#include <hidef.h>
#include "mc9s12dp256.h"
#pragma LINK_INFO DERIVATIVE "mc9s12dp256b"
// Peripheral Initialization
void PeriphInit(void)
{
// Configures PB[7..0] as output
PORTB = 0x00;
DDRB = 0xFF;
// Configures PP[7..0] port as input and enables pull-ups on PP[3..0] port
PTP = 0x00;
DDRP = 0x00;
PERP = 0x0F;
PPSP = 0x00;
// Configures PT[7..0] port as input and enables pull-downs on PT[7..0] pc
PTT = 0x00;
DDRT = 0x00;
PERT = 0xFF;
PPST = 0xFF;
// Configures the ATD peripheral
// (1 conversions per sequence, 8 bit resolution, continuous conversion)
ATD0CTL3 = 0x08;
Line 1 Col 1

6. From the main menu, choose **"Project > Debug"**. This will compile the source code, generate an executable file and download it to the Starter Kit board.
7. A new debugger environment will open.



8. From the main menu, choose **"Run > Start/Continue"**. The program will be executed in real-time. By rotating the potentiometer on the Starter Kit board, you affect the results of the A/D conversion, and the result of each conversion is displayed on the Starter Kit's output section.
9. From the main menu, choose **"Run > Halt"**. The program execution will stop. The next instruction to be executed is highlighted in the *Source* window.
10. From the main menu, choose **"Run > Single Step"**. The instruction highlighted in the *Source* window will be executed, and the program execution will be stopped immediately after.
11. From the main menu, choose **"Run > Start/Continue"**. The application will restart from where it was previously stopped.

Congratulations! You have successfully completed this tutorial! You can continue to experiment with the CodeWarrior user interface and discover by yourself its potentialities. For an in-depth guide of all of the user interface

features, select **“Help > CodeWarrior Help”** from CodeWarrior Development Studio’s main menu.

4 Debugging Features

4.1 Creating Your Own Application

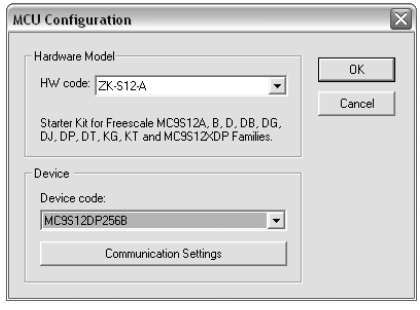
4.1.1 Using the Project Wizard to Create Your Application Skeleton

CodeWarrior Development Studio helps you get started with your own application by including a project wizard specific for HCS12-based SofTec Microsystems boards. To create a new project:

1. From the main menu, select **"File > New"**.
2. A dialog box will appear. Select **"HC(S)12 New Project Wizard"**.
3. Follow the Project Wizard steps, making sure you select the correct microcontroller derivative you are working with and that the **"SofTec Microsystems"** target connection is used.

4.1.2 Starting your First Debugging Session

The first time you enter a debugging session (by selecting **"Project > Debug"** from the CodeWarrior's main menu) the *MCU Configuration* dialog box will open, asking you to select the debugging hardware connected to the PC and the target microcontroller you are working with.



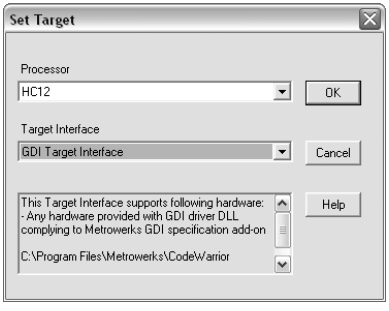
First, ensure that the **"HW code"** parameter is set to your Starter Kit code, then set the **"Device code"** parameter to the specific target microcontroller you are working with. Additional communication parameters can be specified by clicking the **"Communication Settings"** button.

4.2 GDI Target Interface Notes

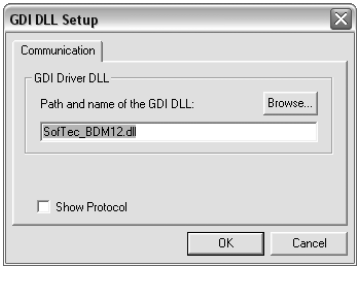
The Starter Kit's built-in USB to BDM interface is based on the SofTec Microsystems' inDART debugging engine. CodeWarrior is interfaced to the inDART engine through a so-called "GDI Target Interface".

If your project has been targeted to an emulator/simulator other than a SK-S12(X) or ZK-S12(X) Series Starter Kit and you wish to use this Starter Kit as the debugger for your project, please do the following:

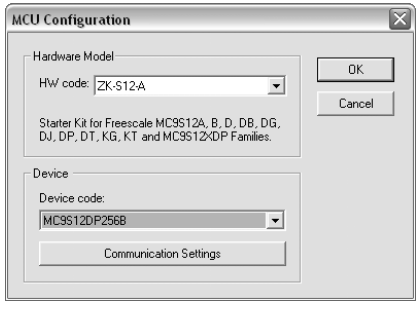
1. From the CodeWarrior debugger interface, select **"Component > Set Target"** and choose **"HC12"** as processor and **"GDI Target Interface"** as target interface.



2. A dialog box will appear asking you to locate the GDI DLL file needed to interface with the Starter Kit. Select the **"SofTec_BDM12.dll"** file located in the **"\Program Files\Metrowerks\CodeWarrior CW12\prog\"** directory.



3. The *MCU Configuration* dialog box will appear allowing you to select the Starter Kit board as the hardware debugger. You must also specify the target microcontroller you are working with.



4. On the CodeWarrior debugger interface a new menu (**"inDART-HCS12"**) will be created. From this menu, select **"Load"** and locate the file your project is based on.

4.3 Breakpoints and Trace

CodeWarrior offers a variety of tools for analyzing the program flow: breakpoints (both simple and complex), watchpoints and a trace buffer. All these features are implemented by taking advantage of the target microcontroller's debug peripheral.

However, depending on the details of the debug peripheral embedded in the specific microcontroller you are working with, some debug features may or may not be available.

Note: *the number of available hardware breakpoints depends on the details of the debug peripheral embedded in the specific microcontroller you are working with, and on its settings.*

Note: *when setting an instruction breakpoint on a RAM location, a software breakpoint is set (the opcode present at that location is automatically replaced by the **"BGND"** Assembly instruction). Therefore, no hardware breakpoints are wasted.*

Note: *the Single Step command (in a C source code) and the Step Over and Step Out commands (both in a C and Assembly source code) use one hardware breakpoint.*

4.4 Notes and Tips

4.4.1 Reading Peripheral Status

Care must be taken when reading some peripheral's status/data registers, since a reading operation may cause the clearing of flags. This may happen when the *Memory* window or the *Data* window is open, since these windows read microcontroller's resources during refresh operations.

4.4.2 Breakpoints and the "BGND" Instruction

The **"BGND"** Assembly instruction forces the target microcontroller to enter the Active Background Debug mode, stopping program execution. CodeWarrior recognizes this event as a breakpoint and updates the contents of registers, memory, etc. Successive commands (**"Start/Continue"**, **"Single Step"**, etc.) will continue the execution of the program from the next instruction.

4.4.3 "STOP" Assembly Instruction

The BDM peripheral doesn't work in STOP mode. If, on the Condition Code Register (CCR), the S bit is set, the STOP instruction will stop all the microcontroller's activities (and therefore the BDM peripheral). If, on the other hand, the S bit is reset, the STOP instruction will be executed as two NOP instructions.

4.4.4 "WAIT" Assembly Instruction

If the SYSWAI bit in the CLKSEL register has been set, the **"WAIT"** instruction will cause a BDM communication loss. This is because the system clock is suspended in WAIT mode, therefore stopping the BDM peripheral.

4.4.5 Microcontroller Peripheral Running when Execution is Stopped

When program execution is stopped, some peripherals will still run while others will stop. Which ones stop and which ones don't depend on the particular peripheral architecture. For more information, please refer to the microcontroller datasheets.

In particular, to cause the COP and RTI peripherals to stop when you stop program execution, the RSBCK in the COPCTL register must have been previously set.

4.4.6 Real-Time Memory Update

During program execution, it is possible to view/edit the contents of the *Memory* window and *Data* window in real time (edit operations are only available for RAM locations and peripheral registers). For example, it is possible to set the periodical refresh of the *Memory* window contents by choosing **"Mode > Periodical"** from the pop-up menu which appears by right-clicking on the *Memory* window.

4.4.7 PLL Usage

The host PC communicates with the microcontroller through the USB to BDM circuitry. The BDM communication speed depends on a clock source, which in turn is selected by the CLKSW bit in the Status register. If the CLKSW bit is set to 1, the BDM communication clock source is the microcontroller's bus frequency; if the CLKSW bit is set to 0, the BDM communication clock source is a constant clock source (in the case of the MC9S12DP256B, for example, it's half the frequency of the external oscillator).

The CLKSW bit can be set (within a debugging session) via the *Communication Settings* dialog box. To open the *Communication Settings*

dialog box, choose **"MCU Configuration"** from the **"inDART-HCS12"** menu. The *MCU Configuration* dialog box will appear. Press the **"Communication Settings"** button.

4.4.8 Hardware Breakpoints and Software Breakpoints

A "hardware" breakpoint is set by taking advantage of the microcontroller's integrated debug peripheral. A hardware breakpoint doesn't waste system resources, you can set/remove them at any time (even during program execution), but the number of available hardware breakpoints is limited.

A "software" breakpoint, on the other hand, does not take advantage of the microcontroller's integrated debug peripheral.

To set a software breakpoint, there are two possibilities: you can set a software breakpoint in RAM or in FLASH. In both cases, an unlimited number of software breakpoints can be set.

To set a software breakpoint in a RAM location, just insert a breakpoint to that location: CodeWarrior will automatically replace the opcode present at that location with the **"BGND"** Assembly instruction.

To set a software breakpoint in a FLASH location, you have to insert the **"BGND"** Assembly instruction into your application's source code, recompile the code and restart a debug session. The program execution will stop as soon as the **"BGND"** instruction is fetched.

4.4.9 Advanced Debugging Features

The microcontroller's built-in DBG12 module allows you to set "complex" hardware breakpoints and to take advantage of a trace buffer.

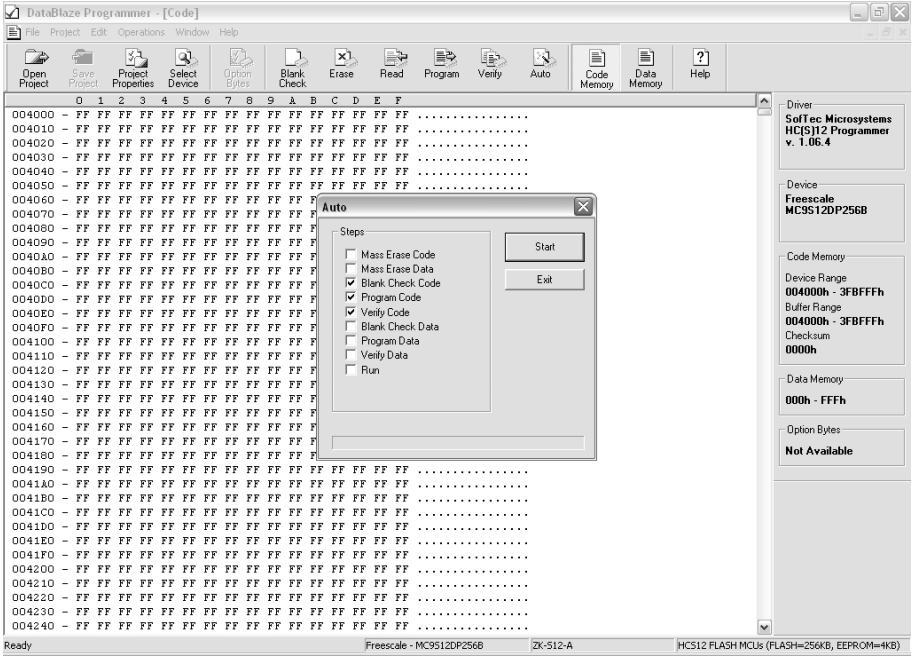
While in debug, under the **"inDART-HCS12"** menu you will find the **"Trigger Module Settings…"** command, that opens a dedicated dialog box which allows you to handle all of the parameters of the microcontroller's debug peripheral.

4.5 DataBlaze Programming Utility

A full-featured programming utility (DataBlaze) is also provided with the Starter Kit. To start the DataBlaze utility select **“Start > Programs > SofTec Microsystems > SK and ZK-S12(X) Series > DataBlaze Programmer”**.

DataBlaze offers the following advanced features:

- Code/data memory editing;
- Blank check/erase/program/verify/read operations;
- Project handling;
- One-button, multiple-operations programming (“Auto” feature);
- Serial numbering.



4.5.1 DataBlaze Notes

- The “Mass Erase” operation always blanks the device (even if the device is protected or secured) and “unsecures” the device (the FLASH Options/Security Byte location is programmed with 0xFE).
- The “Blank Check” operation doesn’t blank check the FLASH Options/Security Byte location.
- The “Program” operation automatically verifies the programmed data by reading back the programmed data and checking it against the buffer sent to the target device. The “Verify” operation is much more secure (but slower), since it reads back the programmed data and checks it against the data buffer present in the host PC.
- In case of verifying error, please verify the value programmed to the FLASH Options/Security Byte location. The bit 0 of this byte is always programmed to 0, so any attempt to program it to 1 will cause a verifying error.

- In the “Auto” operation, a “Run” option is available which, if enabled, resets the microcontroller and runs the user application at the end of programming.

5 Troubleshooting

5.1 Common Problems and Solutions

This section reports solutions to some common problems that may arise during general use.

5.1.1 USB Driver Problems

If you connected the Starter Kit board to the PC before installing the CodeWarrior user interface and the SofTec Microsystems Additional Components, the Starter Kit USB driver may not have been correctly installed on your system. Unplugging and replugging the USB cable is of no use, since Windows has marked the device as “disabled”. As a consequence, CodeWarrior cannot communicate with the Starter Kit board. To restore the USB driver (provided both CodeWarrior and SofTec Microsystems Additional components have been installed), perform the following steps under Windows XP:

1. Make Sure the Starter Kit is powered on.
2. Connect the Starter Kit to the PC (via USB).
3. Open the Control Panel (**“Start > Settings > Control Panel”**).
4. Open the **“System”** options.
5. Select the **“Hardware”** tab.
6. Click the **“Device Manager”** button.
7. The **“uDART In-Circuit Debugger”** device will be shown with an exclamation mark next to it. Double click on this device.
8. In the **“General”** tab, click the **“Reinstall Driver”** button. Follow the on-screen instructions.

5.1.2 Communication Can't Be Established with the Board

1. Make sure the Starter Kit is connected to the PC and powered on.
2. Make sure that the **"BKGD ENA"** and **"RESET ENA"** jumpers in the **"USB TO BDM"** section are inserted.
3. Make sure that the **"MODA=1"** and **"MODB=1"** jumpers are removed.
4. When connecting to the Starter Kit via the built-in USB connector, no external tool must be connected to the BDM connector.
5. Use only the provided USB cable, or a cable that is USB 2.0 compliant.
6. Make sure you are working with the correct hardware model. To view/change the hardware model in use, choose **"inDART-HCS12 > MCU Configuration"** from the CodeWarrior debugger's main menu.
7. If the **"inDART-HCS12"** menu is not present in the CodeWarrior debugger's main menu, this is because the target has not been recognized by CodeWarrior ("No link to Target" appears in the status bar). In this case, from the **"GDI"** menu, choose **"MCU Configuration"** and verify that the hardware code is set correctly.
8. Make sure the target microcontroller is working. Programming and debugging rely on a BDM communication between the "USB to BDM" interface and the target microcontroller. This means that, in order to work correctly, the target microcontroller must be running. In particular, make sure that:

   - On ZK-S12(X) Series Starter Kits, the target microcontroller is correctly inserted in the ZIF socket;
   - On ZK-S12(X) Series Starter Kits, the **"VDD SEL"** jumper in the **"POWER SUPPLY"** section selects the appropriate voltage for the specific microcontroller you are working with;
   - The oscillator circuitry is working according to the microcontroller specifications.

9. For other problems, please refer to your Starter Kit's specific user's manual.

5.1.3 Communication Errors when Using a BDM Tool

When using an external in-circuit debugger/programmer, the built-in USB to BDM interface must be bypassed. To bypass the built-in USB to BDM interface, please remove the **"RESET ENA"** and **"BKGD ENA"** jumpers.

Additionally, the **"MODA=1"** and **"MODB=1"** jumpers must be removed.

5.2 Getting Technical Support

Technical assistance is provided free to all customers. For technical assistance, documentation and information about products and services, please refer to your local SofTec Microsystems partner.

SofTec Microsystems offers its customers a free technical support service at *support@softecmicro.com*. Before getting in contact with us, we advise you to check that you are working with the latest version of the Starter Kit system software (upgrades are available free of charge at *http://www.softecmicro.com*). Additional resources can be found on our HCS12 online discussion forum.

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